STUDY OF BETA HAEMOLYTIC STREPTOCOCCI AND ASO TITRE IN PHARYNGITIS AND ACUTE RHEUMATIC FEVER IN CHILDREN

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BALVAN SINGH YADAV

C E R T I F I C A T E

This is to certify that the work entitled "STUDY OF BETA HAEMOLYTIC STREPTOCOCCI AND ASO TITRE IN PHARYNGITIS AND ACUTE RHEUMATIC FEVER IN CHILDREN" has been carried out by Dr. Balvan Singh Yadav in the department of Paediatrics, M.L.B. Medical College, Jhansi.

He has put in the necessary stay in the department as per university regulations.

Dated: 17 Sept., 1992.

(Ramesh Kumar 17/9/92
MD, DCH,
Professor and Head,
Department of Paediatrics,
M.L.B. Medical College,
JHANSI.

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Dated: 17 Sept., 1992

(R. S. Sethi)
M.D., D.C.H.,
Assistant Professor,
Department of Paediatrics,
M.L.B. Medical College,
JHANSI.

(GUIDE)

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Dated : 17/11 Sept., 1992.

(K. R. Gupta)
M.S.,
Professor and Head,
Department of E.N.T.,
M.L.B. Medical College,
JHANSI

(CO-GUIDE)

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Dated: 17 Sept., 1992

(R. K. Agarwal)
M.D.,
Associate Professor and
Head,
Department of Microbiology,
M.L.B. Medical College,
JHANSI.

(CO-GUIDE)

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B. S. Yadav

(Balvan Singh Yadav)

C O N T E N T S

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I N T R O D U C T I O N

INTRODUCTION

Streptococcal infections constitute an important health problem among the children and young adults. If diagnosed early and treated properly many of them could be saved from developing at least two major recognised complications i.e. acute rheumatic fever and acute glomerulonephritis (Agrawal et al, 1981).

The primary site of invasion of the human body by streptococci is through the upper respiratory tract. Therefore, streptococcal pharyngitis and tonsillitis are by for the most common infections of all streptococcal infections. The clinical diagnosis is difficult, as many other agents may produce similar features, but sudden onset of fever, sore throat (pain on swallowing), headache, with marked inflammation of the pharynx and tonsils, tender enlarged anterior cervical lymph nodes and the scarlatiniform rashes are suggestive of streptococcal pharyngitis (Chaudhary, 1987).

The incidence of streptococcal pharyngitis is variable as reported by various workers. Koshi and Jadhav (1976), Agarwal et al (1981) and Gulari et al (1981) reported the incidence of streptococcal pharyngitis in their study as 44%, 33.84% and 33.3% respectively. Paramesh (1984) and Bhave et al (1991) however, reported a very high incidence of streptococcal pharyngitis viz.

The incidence of acute rheumatic fever may be as high as 3% during an epidemic or as low as 0.3% in endemic areas (Rammel, 1952). Anti streptolysin O (ASO) titre is the commonest test used to detect evidence of streptococcal infection. The higher the titre more is the probability of rheumatic fever (Bhave et al, 1991).

The control of streptococcal infections currently is viewed as the key to the prevention of rheumatic fever and rheumatic heart disease. Accurate recognition of such infections may be considered to afford one of the best approach to control, since appropriate therapy will eliminate the beta haemolytic streptococci from the throat and unnecessary therapy avoided. So, for accurate recognition of these cases, throat swab culture and other laboratory findings become essential diagnostic evidence (Hollinger et al, 1958).

Most of the pathogenic streptococci fall into beta group and are called as haemolytic streptococci. The alpha streptococci are generally commensals in the throat; though they may produce opportunistic infections. Beta haemolytic streptococci form several exotoxins and enzymes (Streptolysin, fibrinolysin, erythrogenic toxins, deoxyribonucleases, proteinases, hyaluronidase etc.), that are potent antigens and antibodies to these antigens regularly appear in the sera following streptococcal infections. In the determination of the antibodies to various strepto-

coccal exoenzymes, preference is given to the determination of antistreptolysin O (ASO), since this sensitive parameter is found to be elevated in about 80 to 85% of the cases (Prakash, 1985).

These antibodies can be demonstrated by 1 week after a streptococcal infection and reach a maximum level by 3 to 5 weeks. An elevated ASO antibody titre persists for 4 to 6 months and disappears there after. Bhave et al (1991) reported that repeated exposure to streptococcal infection may lead to persistent antibody levels in high concentration for a longer period of time.

In view of this, the present study was under taken with the following aims and objectives.

1. To find out the incidence of streptococcal pharyngitis in children and to evaluate throat swab culture positivity in cases of acute rheumatic fever in children.
2. To determine ASO titre in cases of pharyngitis as well as in cases of acute rheumatic fever in children.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Streptococcal pharyngitis is still a common childhood infection and acute rheumatic fever is still prevalent in the many parts of the world. The clinical diagnosis is difficult as many other agents may produce similar clinical features. The rapid antigen detection tests, are specific and very helpful when they are positive but not sensitive enough, to rulout infection when they are negative. So at present the properly performed throat culture is the best way to confirm the clinical diagnosis of the streptococcal pharyngitis (Chaudhary, 1987).

The streptococci produce several enzymes that are potent antigens. Antibodies to these antigens can be demonstrated by 1 week after a streptococcal infection and reach a maximum by 3-5 weeks. An elevated ASO titre can be demonstrated in 75% to 80% of the patients with acute rheumatic fever. Patients with streptococcal pharyngitis also show a rise in ASO titre but generally this titre is not as high as that in patients with acute rheumatic fever.

Streptococci are gram positive, non-motile, non-sporing, oval or spherical organisms that tend to grow in the chains, cocci in chains were first seen in the wound infections by Billroth (1874) who called them streptococci (Streptos, meaning - twisted or coiled). Ogston (1881) isolated them from acute abscesses and established their pathogenecity by animal inoculation. Rosenbach (1884)

isolated the cocci from human suppurative lesions and gave the name streptococcus pyogenes.

Schott muller (1903) first proposed the differentiation of streptococci into haemolytic, partial haemolytic and non haemolytic strains based on their action on the red blood cell in vitro. Brown (1919) introduced the term alpha (∝), beta (β) and gamma (ɣ) to describe slight haemolysis, frank haemolysis and no haemolysis respectively.

1. Alpha (∝) haemolytic streptococci produce a greenish discolouration with partial haemolysis around the colonies. The zone of lysis is small (1 to 2 mm wide), with indefinite margins and unlysed erythrocyte can be made out microscopically within this zone.

2. Beta (β) haemolytic streptococci produce a sharply defined clear colourless zone of haemolysis (2 to 4 mm wide), with in which red cells are completely lysed.

3. Gamma (ɣ) or non haemolytic streptococci, produce no change in medium. These are some times called indifferent streptococci.

Lancefield (1933) classified the beta haemolytic streptococci into several groups based on the nature of a carbohydrate (C) antigen on the cell wall. These are known as Lancefield groups, 18 of which have been identified so far, and named A to T (without I and J). The great majority of beta haemolytic streptococci that produce human infections belong to group A. They are known as Strepto-

coccus pyogenes. These may be further subdivided into types based on the protein (M.T. and R) antigens present on the cell surface (Griffith typing). Eighty M types of Streptococcus pyogenes have been recognised so far.

The individual cocci are spherical or oval 0.5 to 1.0 u m diameter. They are arranged in chains. Chain formation is due to the cocci dividing in one plane only and the daughter cells failing to separate completely. On blood agar, after incubation for 24 hours, colonies are small (0.5 to 1.0 mm) circular semitransparent, low convex discs with an area of clear haemolysis around. Virulent strains, on fresh isolation from lesions, produce a matt (finely granular) colonies, while avirulent strains form glossy colonies.

Beta haemolytic streptococci forms two types of streptolysin. Streptolysin O and streptolysin S. Streptolysin O is oxygen labile and it is inactive in oxidised form but may be reactivated by treatment with reducing agents. It is also heat labile, has specific cardiotoxic and leucotoxic activity and appears to be important in contributing to its virulence. The streptolysin O is antigenic and antistreptolysin O (ASO) regularly appears in the sera following streptococcal infections. Estimation of this antibody titre (ASO titre) is a standard serological procedure for the retrospective diagnosis of the infection with streptococcus pyogenes. Following certain chemical treatments or bacterial contamination, sera may develop inhibitory activity due to some changes in

lipoproteins. Such sera are unfit for ASO test.

Streptolysin S is an oxygen stable haemolysin and responsible for haemolysis seen around the colonies on the blood agar plates. It is a protein but not antigenic. It has been shown experimentally to be nephrotoxic but its significance in pathogenesis is not understood.

With this in the view throat culture programme have been carried out by many workers.

Pike and Pashena (1946) were the first workers to have done a detailed analysis on the frequency of beta haemolytic streptococcal infection in the throat swabs in normal healthy Mexican, Negro and White children attending venereal disease and dental clinics in Dallas over a period of 13 months. They examined 900 throat cultures from 756 children and found that about 42 percent of their subjects were carriers of beta haemolytic streptococci of which 25 percent were carriers of group A strains.

Holmes and Williams (1949) during an 11 week study, in the autumn of 1949 in England, found throat carrier rates of 22.7% for children attending schools and day nurseries.

Dunn and Bunnet (1955) working for community control of rheumatic fever, did culture of 650 children and found only 6 percent of these as carriers of beta haemolytic streptococci.

Saslaw and Streitfeld (1956) conducted a study on 1200 children in order to determine the prevalence of the beta haemolytic streptococci in children at Miami (Fla). However, in contrast to the study by Pike and Pashena(1946) they reported much lower incidence of beta haemolytic streptococci positivity in throat culture (20.1%) of which only 14% were found to be carriers of group A strains.

Quinn et al (1957) reported the natural occurrence of haemolytic streptococci in normal children attending three public school in Nishville (Tenn) mostly between the ages of 8 to 10 years. Quinn and his associates reported 5 antigenic groups A, B, C, D, G and showed that 5% of their strains were of group C, 85% were of group A and 10 percent were of group G. Less than one percent of their culture was made up of 2 B strains and 1 D and 9 were not either A, B, C, D or G. They followed the children with repeated cultures and found that about 59% were showing cultures at some time positive for beta haemolytic streptococci, though of the total cultures only about 18% were positive.

In India a preliminary survey of beta haemolytic streptococci in the throat culture of 2536 presumably normal individuals was carried out by Myers and Koshy (1961). The aim of study was to determine the comparative incidence of the A,B,C, G antigenic groups in the people of an area in the Southern part of India.

This study was conducted during 1957-58. Throat swabs were obtained from the various groups of subjects in an attempt to determine the normal prevalence of beta haemolytic streptococci in various age groups and variation in antigenic groups and types of strains isolated The possibility of seasonal variation was also considered and programme was planned to include three series of culture taken during the autumn rainy season, winter cold season and the spring hot season. One culture from each subject was obtained. The various groups included were as follows :

1. Children attending the outpatient clinics of the Christian Medical College Hospital Vellore and the Mobile dispensaries at a radius of about 20 miles.
2. Teen age "young people including students attending the out patient clinics of the Christian Medical College main hospital, branch hospital or mobile dispensaries. The majority in this group was from 16 to 20 years of age.
3. Adults attending the out patient clinics of main hospital, branch hospitals, or mobile dispensaries. Majority in this group was above the age of 20 years.

This report presents the findings obtained in an 8 months study planned to determine the prevalence and seasonal variation of beta haemolytic streptococcus throat infections and the comparative incidence of the

A.B.C. G antigenic groups in people of an area in the southern part of India. The finding of gross carrier rates for beta haemolytic streptococci above 50 percent in the subject groups surveyed, was not inconsistent with findings in similar studies carried on else where (Pike and Pashena, 1946).

The picture of the distribution of the antigenic groups of the beta haemolytic streptococci, however, appeared to be quite different from those reported elsewhere. Of the 2536 throat cultures examined, 5 percent were found to be positive for group A streptococci, 6 per cent for group B, 8 percent for group C and 13 percent for group G. Less than 1 percent showed the presence of streptococci which failed to fall into one of these four groups. When expressed on the basis of 902 positive cultures isolated from the 2536 specimens 15 percent were identified as a group A strains, 16 percent as group B, 23 percent as group C and 36 percent as group G. One percent of the positive cultures could not be classified as group A,B,C OR G.

The seasonal variation in the prevalence of infection and incidence of antigenic groups of the beta haemolytic streptococci in the various subject age groups did not fall into a constant pattern i.e. for one season the incidence of group A strains, for examples, in subjects of one age group might be some what higher than

for the previous season and in subjects of the next group lower than previously. Likewise there was no consistent seasonal variation from one social group to another. From above observations it was seen that though the general findings were in agreement with those of other (Pike and Pashena, 1946), in that the incidence of beta haemolytic streptococcal infection was similar, but the distribution of antigenic groups of haemolytic streptococci detected appeared to be different from those reported else where (Dunn et al, 1955; Saslaw et al, 1956; Quinn et al, 1957).

Cornfeld et al (1961) did a detailed epidemiological study of streptococcal infections in three elementary schools in philadelphia over a period of 4 years. The workers tried to evaluate the carrier rates of streptococcal infections, the rates of clinically manifest infections and to observe the effect of various schedules of treatment with penicillin on both the carrier rate and the rate of infection.

In the school years 1955 to 1958 children of three schools were followed and throat cultures were taken routinely each month from children developing any of the following symptoms or signs viz. hyperemic pharynx with or without exudate, cervical adenopathy or earache. The presence of fever was also noted. For children whose only complaint was that of sore throat, the throat was examined for evidence of pharyngeal inflammation before the throat

culture was taken. A follow up throat culture was taken after a three week interval on all children who had cultures positive for beta haemolytic streptococci in association with respiratory illness.

During the four years of study more than 50 per cent of children under observation had one or more positive cultures for beta haemolytic streptococci at some time during school years. Despite the carrier rates ranging upto 29.8 percent, the incidence of streptococcal infection varying from 1.4 percent to 2.4 per 100 children studied. This rate was comparable to that reported from England by Williams (1949), who reported 1.9 infection per 100 children per month in a similar school population.

Immunological studies done on these children with throat infection showed no significant difference in the ASO or AH antibodies titres between the children who had positive cultures and those who did not. In addition a number of children without respiratory illness had increased ASO antibodies titres, indicating occurrence of occult infection.

Sharma et al (1966) conducted a comparable study of serological grouping, bacitracin sensitivity and growth on 5% sodium chloride blood agar medium, of beta haemolytic streptococci isolated in Delhi in 1964. They isolated 413 strains of beta haemolytic streptococci from various pathological specimens. Two hundred and twenty six (226) strains were isolated from the acute and chronic infections

of the throat. 51 strains from cervical swabs of patients suffering from puerperal fever and 30 strains from cases of vaginitis and cervicitis. 90 strains were isolated from purulent lesions. All of these 413 strains were grouped serologically using antisera of group A, C and G.

Two hundred and twenty six (226) strains who were isolated from acute and chronic throat infection, of these 118(51.8%) strains belonged to group A, 21 (9.4%) strains belonged to group C and 37(16.5%) strains belonged to group G. The 50(22.3%) strains were of ungrouped streptococci (not belonged to group A, C & G).

Two methods of rapid identification of group A streptococci were evaluated by these workers.

1. Bacitracin sensitivity.
2. Growth on 5% sodium chloride blood agar medium.

This study revealed that bacitracin sensitivity of group A beta haemolytic streptococci to be more reliable. The bacitracin sensitivity test was carried out in two series. In series I, out of 133 strains tested serologically, 122 (91.7%) strains were sensitive to bacitracin and 11 (8.3%) strains were resistant to bacitracin. While in series II, out of 130 strains of group A beta haemolytic streptococci tested serologically 122 (93.7%) strains were sensitive and 8(6.3%) strains were resistant to bacitracin. In series I 20% of non

group A strains were sensitive to bacitracin while in series II only 8.6% strains were sensitive to bacitracin.

Out of 130 group A strains tested serologically 118 (90.7%) strains showed positive growth on blood agar sodium chloride medium.

A study was conducted by Koshi and Mamman (1969) in the out patient department of Christian Medical College Hospital Vellore from July 1965 to November, 1967 to observe the incidence of beta haemolytic streptococcal throat infection and ASO titre in patients suffering from rheumatic fever and from upper respiratory tract infections. 110 normal healthy children served as control for the present study. Their study group comprised of 88 cases of rheumatic fever (age group 4-15 years).

All the patients of rheumatic fever included in the study group fulfilled the modified criteria of Jone's for diagnosis of rheumatic fever. Accordingly there were 34 cases of acute rheumatic fever, 45 cases of chronic recurrent rheumatic fever and 9 cases of rheumatic chorea.

They observed that out of 110 cases which served as control 37 (33.6%) cases were positive for beta haemolytic streptococci, of which 5 (13.5%) cases were positive for group A, 2 (5.4%) cases were positive for group B, 7(18.9%) cases were positive for group C and 23 (62.2%) belonged to group G strains.

In the study group they observed that, of 88 cases of rheumatic fever (48 males and 40 females age

group of 4-15 years), 24 (27.3%) patients were positive for beta haemolytic streptococci. Of these 24 positive cases 7(29.1%) cases were of group A, 1 (4.0%) case was group B, 9(36.0%) cases were of group C and 7 (29.1%) cases were of group G.

The isolation rate for beta haemolytic streptococci was found to be higher in rheumatic fever patients suffering from upper respiratory tract infection. It was seen that out of 42 patients with history of upper respiratory tract infection 35.7% patients were positive for beta haemolytic streptococci, of which one third of the isolates were of group A strains.

Nose culture of 88 patients, showed that 9(10.2%) carried beta haemolytic streptococci, of these 4 were of group A strains. Nasal swabs of control yielded 8(7.2%) cases showing beta haemolytic streptococci, out of which 2 belonged to group A.

The ASO titres, in the control and in patients of rheumatic fever, were compared in order to determine the upper limits for each group. A significant ASO titre (7250 todd units) was observed in children below the 5 years of age and a titre (7333 todd units) was observed in children between 6-15 years of age, in 66 (75.0%) patients of rheumatic fever as against 31 (28.2%) cases of control.

Koshi and Jadhav (1970) examined 248 children under the 15 years of age with acute upper respiratory

tract infections at the out patient department of the C.M.C. Hospital Vellore. Those cases who had received antibiotic therapy prior to inclusion were excluded. Throat swabs for culture were taken from the throat and nose of all the patients at the time of their first visit and during subsequent visits, as well as blood for ASO titration at each visit.

Of 248 cases, there were 135 male and 113 female children. The majority of the patients (101) was in the 3-5 years of age group. Six male and 4 female cases were less than 1 year old. The youngest child included in this study was 45 days old. The analysis did not reveal sex associated differences in the results. The workers found positive throat culture for beta haemolytic streptococci in 109(44%) of the patients. Isolation rates were higher in children of 6-10 (50.7%) and 11-15 (50.3%) year age groups. Considering the total 248 patients, 109(44%) yielded, beta haemolytic streptococci, of which 34(13.7%) were group A, 11 (4.4%) group B, 25 (10.1%) group C and 31 (12.5%) were of group G strains.

ASO titres were also determined in an attempt to assess the immune response in patients with pharyngitis. ASO titres above 250 Todd units in children 5 years and younger and titres above 333 todds units in children older than 5 years were found to be significant. The ASO titre was raised to a significant level in 118(48.4%) of the patients. 96 patients from whom group A

isolations were not made did have elevated ASO titres. Thus laboratory evidence of the streptococcal infection was found for 130(52.4%) patients of the 248 patients with pharyngitis. If isolation of group C and G also were considered as of etiological importance in pharyngitis, 152 (61.3%) patients might be said to have had streptococcal pharyngitis.

Two out of the 213 patients who could be following for 2 years developed acute rheumatic fever giving an attack rate of 0.94% which compares favourably with rates reported in the civilian population else where. Acute glomerulonephritis was not observed in any of this series of patients.

I.C.M.R. conducted a surveillence study in children of the rural areasnear Vellore, from 1975 to 1978 to find out the incidence of streptococcal disease in 3890 children. It was observed that out of 287 children in whom there was clinical suspicion of pharyngitis, 4.9% revealed group A streptococci in their throat cultures and significant ASO antibody titre, while an additional 39.0% showed elevated ASO antibody titre and no group A streptococci, indicating past streptococcal infection of throat or skin.

In another I.C.M.R. supported study carried out in 1981 among 80 children with suspected streptococcal pharyngitis, 13.3% had group A isolation but only 6.7% had group A and significant ASO antibody titre.

Thus true streptococcal throat infections in and around the Vellore have been found to be consistently very low, 8.9% in children attending O.P.D. in mid 1960's, 4.9% in rural school children in mid 1970s, and 6.7% in children attending O.P.D. in 1981.

Gulati and Prabhakar (1981) studied 300 patients of acute pharyngitis below the age of 15 years, attending the ENT out patient department of GND Hospital Amritsar. Their control group comprised of 100 healthy school children of the same age group.

Throat swabs were taken from these 300 cases of acute pharyngitis and from 100 control cases. The throat swabs were inoculated on crystal violet blood agar plates which were incubated at 37°C overnight. The beta haemolytic streptococci isolated were serologically grouped by precipitation using fuller's formamide method.

Their blood samples were also collected to determine the ASO titres. The ASO titres were determined in 95 of the 100 cases of streptococcal pharyngitis and 6 of the 100 control cases.

Among 300 patients of acute pharyngitis that were studied beta haemolytic streptococci were isolated in 100 children. Giving an incidence of 33.3% while out of the 100 control group of cases only 6(6%) revealed the growth of beta haemolytic streptococci. Sixty eight(68%) percent of the strains isolated from cases of streptococcal pharyngitis were of group A, 11% of group C, 18% of group G and only 1% belonged to group B. Two percent of the

strains non-groupable by A,B,C and G antisera.

Out of the 6 isolates from control group 3 were of group G, 2 of group A and one case was of group C. All the beta haemolytic streptococci isolated from the cases of pharyngitis and carriers were sensitive to penicillin. Sixty three (92.6%) of the 68 group A strains were sensitive to bacitracin. While 27(84.4%) of the 32 non group A strains were resistant to bacitracin. Significant ASO titres (71:200) were obtained in 43(45.3%) cases of streptococcal pharyngitis and in 3 of the 6 control cases.

Agrawal et al (1981) have conducted a study on 452 primary school children from three primary schools of the Lucknow city. This study was carried out from March 1981 to May, 1981. The aim of this study was to find out the beta haemolytic streptococcal carrier rate among school children at Lucknow. Attempts have also been made to study various antigenic groups of the streptococcal isolates and their relationship with associated disease conditions. All the children ranged in the age group of 5 to 14 years.

All the children were thoroughly examined with special emphasis on the throat, for any detectable signs of streptococcal disease and relevant information was collected on a pretested schedule. Throat swabs were collected from the children on sterile cotton wool swabs with all aseptic precautions. The specimens obtained were immediately inoculated on 5% sheep blood agar plates and

incubated aerobically for 18 to 24 hours at 37°C. The plates were then examined for the presence of beta haemolytic streptococcal colonies. The serological grouping of the streptococcal isolates was done using precipitin reaction.

There were 292 male children and 160 females. The streptococcal throat positivity was found to be higher in males (16.1%) than that observed in the females (14.4%) however, this difference was not found statistically significant ($p > 0.05$).

Out of 452 school children that were studied, 46 presented as sore throat, 32 as pharyngitis, 52 as tonsillitis, 5 as rheumatic heart disease and 317 were of apparently healthy children. Of these 452 children beta haemolytic streptococci was isolated from the throat of the 70 children, thus giving an overall infection rate of 15.5%. Of these 70 positive cases, 9 cases were of sore throat, 12 cases were of pharyngitis, 23 cases were of tonsillitis, 1 case was of rheumatic heart disease and 25 cases belonged to group of apparently healthy children.

Out of the total 70 strains that were isolated grouped serologically showed that 35 (50%) strains belonged to group G followed by group A - 24(34.3%), group B - 5(7.1%) and group C - 3(4.3%). Three strains (4.3%) could not be grouped with the available antisera. This study showed that group A strain more often associated with the conditions like tonsillitis and pharyngitis

whereas group C was more in healthy carriers. There were only 5 strains of group B of which 3 were from healthy children and one each from children suffering with pharyngitis and sore throat. Similarly, of 3 strains of group C, 2 were from healthy subjects and one from a child with sore throat. Only one out of 5 children with rheumatic heart disease showed presence of streptococci in his throat.

Paramesh (1984) in his study examined 50 children (the youngest in the study was 15 months and oldest was 17 years) with fever and sore throat and submitted their throat swabs for culture and sensitivity. The aim of this study was to find out the prevalence of the streptococcal infection in children with acute sore throat and to find out correlation of culture positive streptococcal infection with combination of clinical signs.

All cases were from higher socio-economic and education status families. Throat swabs were taken from all cases. Care was taken to swab both the tonsils and posterior pharynx. The swabs were cultured on blood agar plates within the 15 minutes after the collection and incubated at 37°C. Twelve to 18 hours after a good colony was identified.

In 31 out of 50 cases, throat swabs grew group A beta haemolytic streptococci constituting 62% cases. Ten positive cases (38.5%) were below 5 years and 21 (61.5%) cases were above 5 years. There were 17 male and 14

female patients. One case grew staphylococcus aureus who had exudate on tonsils. The maximum incidence was noticed in the month of June.

Of these 31 beta haemolytic group A positive cases, fever was present in 90.4% cases, sore throat in 80.4% cases, headache in 38.7% cases, nausea and vomiting in 38.7% cases, red throat in 90% cases, cervical lymphadenitis in 50% cases, exudate in 38.7% cases and petechae in 9.6% cases. When combination of clinical symptoms and signs were taken into consideration, red throat and cervical lymphadenitis were positive in 50.0% cases, red throat and exudate in 55.8% cases, red throat, exudate and cervical lymphadenitis in 75% cases, red throat, exudate, cervical lymphadenitis and petechae in 100% cases.

The workers tried to drive correlation between the clinical symptomatology to the streptococcal positivity in the study. They observed that a single clinical sign was not much help in predicting the streptococcal sore throat but a combination of signs viz. red throat, exudate, cervical adenitis and petechae showed 100% streptococcal positivity. However, clinical evaluation is not the substitute for culture since one cannot differentiate streptococcal infection from other infections including viral infection, on clinical ground alone.

Shave et al (1991) estimated ASO titre in health and disease states in children and young adults to find out the incidence of rheumatic fever in Bombay city.

The aims of this study were :

1. To determine ASO antibodies in normal population and compare these values that observed in patients of rheumatic fever.
2. To assess ASO antibodies in children suffering from clinically diagnosed streptococcal pharyngitis and correlate them with bacteriological cultures of the throat.
3. To find out the point prevalence of rheumatic heart disease in children under 15 years.

They divided the case material in two groups. 499 children between the age of 1 month to 12 years attending a general hospital for various non infective conditions were selected to represent normal child population and 288 young adults (712 years) from both upper and lower socio-economic groups and free from recent infection, were selected to represent normal young population. ASO antibodies were estimated in all these control group of cases by using latex agglutination test.

A total of 522 children with active rheumatic carditis represented the population of rheumatic fever patients. The diagnosis of rheumatic heart disease was made by radiological and electrocardiographic criteria. Patients with rheumatic carditis were those who were considered their physician to be in active stage of disease and were treated by aspirin and/or steroids.

76 children clinically diagnosed as suffering from acute bacterial throat infection were subjected to throat swab culture for bacteriological examination and blood examination for ASO antibodies on the same day, were also included in this study.

They found that normal children below the age of one year had no detectable ASO antibodies. Further they observed that the ASO antibodies progressively increased with age - 7.9% in the age group of 1-3 years, 11.8% in the age group of 4-8 years and 15.8% in the age group of 9 to 12 years. All these children below 12 years and belonged to the low socio-economic group. Children above 12 years and young adults showed ASO positivity in 10.8% subjects. It was seen that while in lower socio-economic group ASO positivity was 16.7% and it found to be lower (9.2%)in subjects of higher socio-economic status.

In study group cases the workers observed that out of 522 rheumatic fever patients, 122(23.4%) had either no antibodies or insignificant antibodies, 256 (49%) had ASO antibodies of 200 IU/ml and 144 (27.6%) had ASO antibodies of 7 400 IU/ml.

Throat swab culture and ASO antibody titre were done simultaneously in 76 out door patients clinically diagnosed as acute pharyngitis. Group A beta haemolytic streptococci were isolated in 50 (65%) cases

and significant ASO titres were seen in 49(64.4%) patients. Both positive culture and elevated ASO titre were seen in 38 (50%) cases.

The point prevalence of rheumatic heart disease was significantly higher (0.17%) in the lower socio-economic group as compared to the higher socio-economic group (0.05%).

MATERIAL AND METHODS

MATERIAL AND METHODS

The present study was carried out in the department of Paediatrics in collaboration with the department of Microbiology and E.N.T., M.L.B. Medical College, Hospital, Jhansi over a period of one year from April 1991 to March, 1992.

SELECTION OF CASES

Children (1 to 15 years of age) attending the out patients department and those admitted in the Paediatric ward were selected for the present study.

They were divided into following two groups.

A. Control Group

The control group of cases comprised of normal healthy children below 15 years of age who had absolutely no evidence of any systemic disease, pharyngitis, tonsillitis, sinusitis or otitis. Ten children fulfilling the above criteria served as control in the present study. Prior to inclusion in this group a detailed history was taken and complete examination was done to exclude any illness.

B. Study Group

The study group of cases comprised of the two following subgroups :

1. Cases of pharyngitis.
2. Suspected cases of acute rheumatic fever and rheumatic heart disease.

Our study group consisted of 50 cases of acute pharyngitis and 12 cases of acute rheumatic fever.

Selection of Control Group

Children selected in this group did not suffer from pharyngitis or tonsillitis as proved by lack of any symptoms or signs suggestive of acute pharyngitis and tonsillitis in them or absence of history of respiratory tract infection, fever, cough, sore throat in the past. Non of these children had any other systemic illness.

Selection of Study Group

1. Selection of cases of Pharyngitis

Fifty children suffering from acute pharyngitis, tonsillitis, upper respiratory tract infection were included in this group. The diagnosis of acute pharyngitis was based on the history of fever, sore throat, cough, coryza, pain or difficulty in deglutition and was supported by clinical examination of throat, which revealed inflammation and exudate on the tonsils and pharynx. Along with inflammation of throat there was also association of enlarged tender cervical lymphadenopathy in few cases of pharyngitis. The diagnosis of streptococcal pharyngitis was confirmed by the throat swab culture, sensitivity for

beta haemolytic streptococci and by determining the ASO titres.

2. Selection of cases of Acute Rheumatic Fever

The clinical diagnosis of acute rheumatic fever was based on the modified Jone's criteria. At least one major and two minor or two major criteria were taken for diagnosing cases of rheumatic fever. Due emphasis was given to elicit history of past streptococcal infection, fleeting arthritis, carditis, chorea and any evidence of decompensation of the heart. The diagnosis was supported by clinical examination of joints, cardiovascular system and confirmed by investigation viz. rise in acute phase reactant, increased ASO titre, throat culture and sensitivity, ECG and X-ray chest.

The name, age, sex, address, history, physical examination and investigations done were recorded on a specially prepared proforma in each case.

HISTORY

A detailed present, past and family history were recorded in each case, keeping in the view the diagnosis of pharyngitis and acute rheumatic fever.

In each case a detailed account of history of present illness viz. sudden onset of high grade fever, cough, coryza, sore throat, dysphagia, abdominal pain, vomiting, scarlatiniform rashes, neck swelling, joint

pain and swelling, chest pain, breathlessness, palpitation and any abnormal movements were recorded.

Past illness, if any of recurrent fever, cough, sore throat, joint pain and swelling and breathlessness were also inquired in each case.

Family history of rheumatic fever and tuberculosis were also recorded in each case. The developmental immunization and socio-economic status were also recorded in detail in each case.

PHYSICAL EXAMINATION

A thorough physical examination was done in each case to collaborate the diagnosis of acute pharyngitis and acute rheumatic fever. This included, a general examination of patients, for evidence of fever, tachycardia, tachypnoea, anaemia, cyanosis, clubbing, oedema, subcutaneous nodule, erythema - marginatum, or any evidence of rheumatic chorea.

The local examination in a case of acute pharyngitis, included the examination of pharynx, tonsils, anterior and posterior pillars for any evidence of congestion, inflammation, presence of exudate and acute or chronic tonsillar hypertrophy. Due emphasis was also given to search for lymph nodes enlargment in the cervical region, which is often an association of pharyngitis and tonsillitis.

Local examination in a case of acute rheumatic fever included the examination of involved joints for any

evidence of arthritis in form of presence of swelling, tenderness, redness and restriction of movements of the involved joints.

A thorough systemic examination of cardio-vascular system, respiratory system, nervous system and abdomen was also done in each case.

Anthropometric measurements viz. height, weight, head circumference, mid arm circumference were also recorded in each case.

INVESTIGATIONS

The clinical diagnosis was substantiated by various laboratory investigations. Routine blood examination viz., total leucocyte count, differential leucocyte count, Hb%, erythrocyte sedimentation rate and urine examination was done in each case. Throat swab culture, sensitivity and ASO titre were also done in each case. X-ray chest and E.C.G. were done wherever needed.

Collection of Throat Swab

Throat swab was collected from each patient. Care was taken to swab both the tonsils and posterior pharyngial wall. It was sent to the laboratory as early as possible.

Throat Swab Culture

In the laboratory the swab was inoculated on blood agar (BA) and MacConkey agar (MA) plates. Blood

agar plate was incubated in a candle jar at 37°C. MA plate was incubated as such at 37°C. The plates were examined next morning. Streptococcus pyogenes was suspected when small, greyish white, transluscent beta haemolysis producing colonies were seen. It was confirmed by Gram's staining and negative catalase reaction. A presumptive identification of group A was made by bacitracin sensitivity.

Collection of Blood Sample

For ASO titre, 1 ml blood was withdrawn aseptically by venepuncture in a plain vial. It was allowed to clot and serum was separated.

Estimation of ASO titre

The test was done as per manufacturer's direction employing Behring's kit - Rapitex ASL. Briefly, one part of patient's serum was diluted with five part of normal saline. One drop of this diluted fluid was mixed with one drop of the latex reagent on a slide. The slide was rocked for maximum two minutes and was looked for agglutination of the latex particles against a dark background. If the test was positive with this serum dilution, it meant that the ASO titre was 200 IU/ml. Higher dilution of the serum were tested to find out the exact titre of the antibody. Presence of agglutination with 1 : 5 dilution indicated ASO antibody titre of 200 IU/ml, while agglutination with 1 : 10 dilution indicated titre of 400 IU/ml and so on.

O B S E R V A T I O N S

OBSERVATIONS

A study to assess the incidence of streptococcal pharyngitis and to determine ASO titre in cases of pharyngitis and in cases of rheumatic fever was carried out in 72 children (1 to 15 years of age) at M.L.B. Medical College Jhansi from April, 1991 to March, 1992 over a period of 12 months. Besides throat swab culture and ASO titre, various clinical features were noted and routine blood investigations were also done in each case. X-ray chest and ECG were performed whenever required.

A total of 72 cases were examined in the present study (Table I). It is evident from the table that 10 normal healthy children served as control in the present study. The study group comprised of a total of 62 cases of which 50 cases were of pharyngitis and 12 cases were of acute rheumatic fever.

TABLE I : Showing the various groups of cases.

Groups	No. of cases
1. Control group	10
2. Study group	
A. Acute pharyngitis	50
B. Rheumatic fever	12
TOTAL	72

All the 10 control group cases were males. Their age ranged from 4 to 15 years and they belonged to low socio-economic group.

Age and sex distribution of 50 cases of pharyngitis group are shown in table II. Out of total 50 cases, 38(76%) cases were male and 12 (24%) cases were female . It is also evident from the table that maximum number of cases 22(44%) were in the age group of 4-6 years, followed by 16 (32%), 10(20%) and 2(4%) cases in the age group of 1-3 years, 7-9 years and 10-12 years respectively. There was no case in the age group of 13-15 years.

TABEL II : Showing age and sex distribution in cases of pharyngitis.

Age group (years)	Total No.of cases	Percentage	Males		Females	
			No.	%	No.	%
1 - 3	16	32	13	26	3	6
4 - 6	22	44	15	30	7	14
7 - 9	10	20	8	16	2	4
10 - 12	2	4	2	4	-	-
13 - 15	-	-	-	-	-	-
TOTAL	50	100	38	76	12	24

Age and sex incidence of 12 cases of acute rheumatic fever is shown in table III. Out of the 12 cases of acute rheumatic fever examined, 9(75%) were male and 3(25%) cases were female. It is evident from the

table that maximum number of cases 5(41.66%) were in the age group of 10-12 years, followed by 3(25%) cases in the age group of 4-6 years and 2(16.67%) cases in each 7-9 and 13-15 years age group. However, there was no case in the 1-3 years age group.

TABLE III : Showing age and sex incidence in cases of acute rheumatic fever.

Age group (years)	Total No.of cases	Percentage	Males		Females	
			No.	%	No.	%
1 - 3	-	-	-	-	-	-
4 - 6	3	25.00	2	16.67	1	8.33
7 - 9	2	16.67	2	16.67	-	-
10 - 12	5	41.66	4	33.33	1	8.33
13 - 15	2	16.67	1	8.33	1	8.38
TOTAL	12	100.00	9	75.00	3	25.00

TABLE IV : Showing the socio-economic status in the cases of pharyngitis and acute rheumatic fever.

Socio-economic status	Cases of pharyngitis		Cases of Rh. fever	
	No.	Percentage	No.	Percentage
Lower	30	60.00	10	83.33
Middle	20	40.00	2	16.67
Higher	-	-	-	-
TOTAL	50	100.00	12	100.00

The socio-economic status of 50 cases of pharyngitis and 12 cases of acute rheumatic fever is shown

in table IV. The socio-economic status was divided in 3 categories viz. lower, middle and higher according to per capita income.

It is evident from the table IV that maximum number of cases of pharyngitis (60%) as well as rheumatic fever (83.33%) belonged to lower socio-economic status, while 20(40%) cases of pharyngitis and 2(16.67%) cases of rheumatic fever belonged to middle socio-economic status. A striking observation was that no case of pharyngitis and rheumatic fever belonged to higher strata of the society.

The clinical features of both the study groups were observed in detail in each and every case. Accordingly the symptoms and signs of cases of pharyngitis are depicted in table V and VI respectively.

TABLE V : Showing the symptoms in cases of pharyngitis (N=50).

Symptoms	No.of cases	Percentage
1. Cough	50	100.00
2. Fever	42	84.00
3. Sore throat	35	70.00
4. Pain and swelling over neck.	8	16.00

It is evident from the table V that all the 50 cases of pharyngitis presented with cough, 42(84%) cases had fever and 35(70%) cases presented with sore throat. The complaints of pain and swelling over neck were found only in 8(16%) cases.

TABLE VI : Showing signs in cases of pharyngitis.

Signs	No.of cases	Percentage
1. Inflammation and congestion of pharynx	50	100.00
2. Inflammation and congestion of tonsils	22	44.00
3. Inflammation and congestion of pillars.	22	44.00
4. Cervical adenitis	8	16.00

Table VI shows that all the 50 cases of pharyngitis had evidence of inflammation and congestion of the posterior pharyngeal wall. The associated evidence of tonsillitis in form of inflammation and congestion of the tonsils and pillars was observed in 22(44%) cases. The evidence of cervical adenitis was found only in 8(16%) cases. A significant finding noted by us was that cervical adenitis was observed only in those cases who had tonsillitis along with pharyngitis.

The incidence and percentage of symptoms and signs of the 12 children suffering from acute rheumatic fever have been shown in the table VII and VIII respectively.

It is evident from the table VII that all the 12 cases (100%) of acute rheumatic fever presented with complaints of fever and all had evidence of pain and swelling of the involved joints. Fifty percent of the cases presented with complaints of breathlessness. Three

cases (25%) presented with chest pain, cough and sore throat. Palpitation was however, observed in only one (8.33%) case.

TABLE VII : Showing the symptoms in cases of acute rheumatic fever.

Symptoms	No.of cases	Percentage
1. Fever	12	100.00
2. Joint, pain and swelling	12	100.00
3. Breathlessness	6	50.00
4. Chest pain	3	25.00
5. Cough	3	25.00
6. Sore throat	3	25.00
7. Palpitation	1	8.33

TABLE VIII : Showing signs in cases of acute rheumatic fever.

Signs	No.of cases	Percentage
1. Joint swelling and redness	12	100.00
2. Joint tenderness	12	100.00
3. Restriction of joint movement	12	100.00
4. Signs of carditis	6	50.00
5. Signs of CHF	6	50.00
6. Subcutaneous nodule	-	-
7. Erythema marginatum	-	-
8. Rheumatic chorea	-	-

Table VIII shows that all the 12(100%) cases of acute rheumatic fever had evidence of one or more joint involvement in the form of joint swelling, redness, tenderness and restriction of joint movements. It was observed that after treatment the swelling subsided rapidly without leaving any residual deformity of the joints. The signs of carditis and congestive heart failure in form of tachypnoea, tachycardia, raised jugular venous pressure, enlarged tender, liver and pedal oedema were observed in 6(50%) cases. None of the cases had subcutaneous nodule, erythema marginatum or any evidence of rheumatic chorea. The associated evidence of pharyngitis and tonsillitis in form of inflammation and congestion of pharynx and tonsils were observed in 3(25%) cases. Enlarged cervical lymph nodes were seen only in 2(16.67%) cases.

The range as well as mean haemoglobin values and erythrocyte sedimentation rates of various study groups have been shown in the table IX.

TABLE IX : Showing the Hb% and E.S.R. in various groups of the cases.

	groups	Hb gm%		ESR (mm in 1st hour	
		Mean	Range	Mean	Range
1.	Control	12.00	11-14	19.00	12 - 25
2.	Study group				
A.	Pharyngitis	10.66	9 - 13	22.52	15 - 35
B.	Acute Rheumatic fever	8.33	7.5-12.0	43.00	30 - 56

Table IX reveals that mean haemoglobin value in our control group of cases was 12.0 gm% (Range 11-14 gm%) and mean erythrocyte sedimentation rate was 19.0 mm in 1st hour (range 12 to 25 mm in 1st hour). The mean haemoglobin value in cases of pharyngitis was 10.66 gm% with range of 9 to 13 gm% and mean erythrocyte sedimentation rate was 22 . 52 mm in 1st hour (range 15 to 35 mm in 1st hour). The mean haemoglobin value in cases of acute rheumatic fever was 8.83 gm% (range 7.5 to 12.0 gm%) and mean erythrocyte sedimentation rate was 43.0 mm in 1st hour (range 30 to 56 mm in 1st hour).

Throat swab culture reports in control and study groups have been shown in table X.

TABLE X : Showing the throat swab culture reports in the various groups of cases.

Bacteria	Control group (n=10)		Cases of pharyngitis (n=50)		Cases of Acute rheumatic fever (n=12)	
	No.	%	No.	%	No.	%
Beta haemolytic streptococci	1	10.00	12	24.00	4	33.33
Staphylococcus aureus	1	10.00	7	14.00	-	-
Nonpathogenic growth(commensals of the throat)	8	80.00	30	60.00	8	66.67
Others	-	-	1	2.00	-	-
TOTAL	10	100.00	50	100.00	12	100.00

It is evident from the table X that out of 10 control cases, throat swab culture of one (10%) case showed the growth of beta haemolytic streptococci. One(10%) case showed the growth of staphylococcus aureus, while throat swab culture of remaining 8(80%) cases showed the growth of nonpathogenic bacteria (commensals of the throat).

Out of 50 cases of pharyngitis, 12(24%) cases showed the growth of beta haemolytic streptococci, 7(14%) cases showed the growth of staphylococcus aureus, while only 1 (10%) case had growth of micrococcus. The throat swab culture of the remaining 30(60%) cases showed growth of non pathogenic bacteria on the culture medium.

Throat swab culture was also done in all the 12 cases of acute rheumatic fever. Our results revealed that out of 12 cases of acute rheumatic fever, throat swab cultures of only 4(33.33%) cases were positive for beta haemolytic streptococci, while the throat swab culture of the remaining 8(66.67%) cases showed the growth of the non pathogenic bacteria on the culture medium.

It was our endeavour to assess the ASO titre in all the group of cases and to find out in each group whether ASO titre was significant ($\geq$200 IU/ml) or insignificant ($<$200 IU/ml). Further we also tried to find correlation, if any, between the ASO titre as well as bacterial growth on throat swab culture (Table XI).

TABLE XI : Showing ASO titres in various groups of cases.

ASO titre	Control cases		Cases of Pharyngitis		Cases of acute rheumatic fever	
	No.	%	No.	%	No.	%
Insignificant (⟨200 IU/ml)	9	90.00	42	84.00	3	25.00
Significant (⟩200 IU/ml)	1	10.00	8	16.00	9	75.00
TOTAL	10	100.0	50	100.00	12	100.00

It is evident from the table XI that out of 10 control cases only 1(10%) case had significant (⟩200 IU/ml) ASO titre. This was the case in whom throat swab culture showed growth of beta haemolytic streptococci (Table XII). The remaining 9(90%) cases had insignificant (⟨200 IU/ml) ASO titre. Of these 9 cases, throat swab culture of 1(11.11%) case showed growth of staphylococcus aureus while remaining 8(88.89%) cases showed the growth of non pathogenic bacteria on the culture medium (Table XIII).

Table XI also reveals that out of 50 cases of pharyngitis only 8(16%) cases had significant (⟩200 IU/ml) ASO titre. The remaining 42(84%) cases had insignificant (⟨200 IU/ml) ASO titre. It is evident from the table XII that out of 8 significant ASO titre cases, throat swab culture of the 4(50%) cases showed growth of beta haemolytic streptococci while remaining 4(50%) cases showed growth of non pathogenic bacteria on the culture medium.

TABLE XII : Showing throat swab culture in various significant ASO titre cases.

Various groups	Significant ASO Titre cases						Throat swab culture							
	200- <400 IU/ml		400-<600 IU/ml		Total		Beta haemolytic streptococci		Staphylococcus aureus		Non pathogenic growth		Others	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Control cases (n=10)	1	10	-	-	1	10	1	100	-	-	-	-	-	-
Cases of pharyngitis (n=50)	8	16	-	-	8	16	4	50	-	-	4	50	-	-
Cases of acute rheumatic fever (n=12)	6	50	3	25	9	75	4	44.44	-	-	5	55.56	-	-

TABLE XIII : Showing throat swab culture in various insignificant ASO titre cases.

Various groups	Insignificant ASO titre cases (⩽200 IU/ml)		Throat swab culture							
			Beta haemolytic streptococci		Staphylococcus aureus		Non pathogenic growth		Others	
	No.	%	No.	%	No.	%	No.	%	No.	%
1. Control cases (n=10)	9	90	-	-	1	11.11	8	88.89	-	-
2. Study group										
A. Pharyngitis cases(n=50)	42	84	8	19.06	7	16.66	26	61.90	1	2.38
B. Cases of acute rheumatic fever (n=12).	3	25	-	-	-	-	3	100.00	-	-

Out of 42 insignificant ASO titre cases, as depicted in table XIII, throat swab culture of 8(19.06%) cases showed growth of beta haemolytic streptococci, 7(16.66%) cases showed growth of staphylococcus aureus, 1(2.38%) case showed growth of micrococcus, while remaining 26(61.90%) cases showed non pathogenic growth on the culture medium.

Table XI also shows that out of 12 cases of acute rheumatic fever, 9(75%) cases had significant (≥200 IU/ml) ASO titre while the remaining 3(25%) cases had insignificant (<200 IU/ml) ASO titre. It is evident from the table XII, that of the 9 cases showing significant ASO titre, 6(50%) cases had ASO titre ≥200 IU/ml but <400 IU/ml and 3 cases had ASO titre ≥400 IU/ml but <600 IU/ml. Of the 9 significant ASO titre cases, throat swab culture of the 4(44.44%) cases showed growth of beta haemolytic streptococci while remaining 5(55.56%) cases showed growth of non pathogenic bacteria on the culture medium (Table XII).

Further it is evident from the table XIII that the throat swab culture of the all 3 insignificant ASO titre cases (100%) revealed non pathogenic growth on the culture medium.

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D I S C U S S I O N

D I S C U S S I O N

The present work was carried out to study the throat swab culture and ASO titre in 50 cases of pharyngitis and 12 cases of acute rheumatic fever (1 to 15 years of age). Ten normal healthy children served as control in the present study. The study was conducted in the department of Paediatrics in collaboration with departments of Microbiology and E.N.T. at M.L.B. Medical College, Hospital, Jhansi over a period of one year from April, 1991 to March, 1992.

Primary aim of our study was to find out the incidence of streptococcal pharyngitis and to determine the ASO titre in cases of pharyngitis as well as in cases of acute rheumatic fever in children and to compare these values with those obtained in control cases.

Beside evaluating the throat swab culture and ASO titre various clinical features were noted and routine investigations were done in each case. It was our endeavour to ascertain a possible inter-relationship between the ASO titre and the bacterial growth on throat swab culture examination and also to find out whether the rise of ASO titre was in any way correlated to greater incidence of streptococcal infection.

In the light of observations depicted in table I to XXII, following inferences have been drawn and discussed in detail.

A total of 72 cases were examined in the present study, comprising of 50 cases of pharyngitis and 12 cases of acute rheumatic fever. Ten normal healthy children served as control in the present study as shown in table I.

The age and sex distribution of cases of pharyngitis(Table II) revealed that out of 50 cases of pharyngitis, 38(76%) cases were male and 12(24%) cases were female. The majority of cases, 22(44%) cases were in the age group of 4-6 years, followed by 16(32%) cases, 10(20%) cases and 2(4%) cases in the age group of 1-3, 7-9 and 10-12 years respectively. This pattern of age distribution of cases of pharyngitis amply demonstrates, that upper respiratory tract infection(particularly pharyngitis) predominates below 6 years of age (76%) and the incidence gradually declines as the age advances beyond 6 years.

Similarly the age and sex distribution of 12 cases of acute rheumatic fever depicted in table III reveals that 9(75%) cases were male and 3(25%) cases were female. A significant finding, as expected, was that there was no case of rheumatic fever below 3 years of age. The highest incidence of acute rheumatic fever was observed in the 10-12 years age group (41.66%), followed by 25% and 16.67% each in 4-6, 7-9 and 13-15 years age group respectively.

Since both pharyngitis and acute rheumatic fever are basically diseases which predominate in low socio-economic conditions (poor hygiene and over crowding), it was our endeavour to observe the socio-economic status of all the cases. Accordingly it is evident from table IV, that maximum number of cases of pharyngitis (60%) as well as acute rheumatic fever (83.33%) belonged to low socio-economic status, while 40% cases of pharyngitis and 16.67% cases of acute rheumatic fever belonged to middle socio-economic status. A striking observation was that no case of pharyngitis and rheumatic fever belonged to higher strata of the society

ASO titre and throat swab culture have been evaluatedb by different workers over the past couple of years. Nearly all the workers viz. Koshi and Mammen (1969), Koshi and Jadhav (1970), Agarwal et al (1981), Gulati et al (1981) and Paramesh (1984), like us, took up both group of cases only in paediatric age group viz. ≤15 years of age. However, Bhave et al (1991), the latest study available, evaluated these parameters in young adults also. Majority of the above workers had not divided their case material in different age groups, hence our findings of increased incidence of pharyngitis below 6 years and highest incidence of acute rheumatic fever between 10-12 years of age group could not be substantiated. Koshi and Jadhav (1970) however, are the only workers to have observed that majority of their cases of

upper respiratory tract infection (40.8%) were in the age group of 3 to 5 years.

Our findings of increased incidence of both pharyngitis and acute rheumatic fever in male as compared to female (76% and 75%) respectively) has also been substantiated by various other workers in the field. Surprisingly three workers viz. Koshi and Mamman (1969), Koshi and Jadhav (1970) and Paramesh (1984) reported high and more or less equal incidence of 54.54%, 54.47% and 54.83% respectively in their studies.

Agrawal et al (1981) too, reported a higher incidence of upper respiratory tract infection in males (64.60%) as compared to the other workers, though their incidence was slightly less than the incidence of U.R.I. in males observed by us.

Bhave et al (1991) are the only workers to have commented on the socio-economic status of the both group of cases and like us, observed a higher incidence in low socio-economic group.

The symptoms and signs in our cases of pharyngitis have been shown in tabl V and VI respectively. Our observations revealed, that all 50(100%) cases of pharyngitis had cough, while 42(84%) cases presented with fever, 35(70%) cases presented with sore throat and 8(16%) cases presented with pain and swelling over neck. Our findings as depicted in table VI, showed that all the 50 cases of pharyngitis had inflamation

and congestion of the pharynx. Twenty two (44%) cases revealed inflammation and congestion of the tonsils and 8(16%) cases had evidence of cervical adenitis.

The incidence and percentage of symptoms and signs in 12 cases of acute rheumatic fever has been depicted in table VII and VIII respectively. Our findings revealed that all the 12 cases of acute rheumatic fever presented with complaints of fever, pain and swelling of the involved joints (100%). Six(50%) cases presented with complaints of breathelessness. The complaints of chest pain, cough and sore throat were observed in 3(25%) cases. Palpitation was however, observed only in one case (8.33%).

It is evident from table VIII, that all our 12 cases of acute rheumatic fever had evidence of joint swelling, tenderness, redness and restriction of movements of the involved joints. Fifty percentage cases had evidence of carditis and congestive heart failure. None of the our cases had any evidence of subcutaneous nodules, erythema margination or rheumatic chorea. The associated evidence of pharyngitis and tonsillitis was observed in 25% cases. Cervical adenitis was seen only in 2(16.66%) cases.

Paramesh (1984) was the only worker to have evaluated clinical features in 31 cases of pharyngitis and observed more or less similar incidence of fever, sore throat and signs of inflammation in the throat.

He observed that 90.4% of the cases presented with the complaint of fever, 80.4% with complaints of sore throat and 38% cases with complaint of headache, nausea and vomiting. On examination evidence of red throat was observed in 90% cases. Cervical adenopathy was however, reported by them in 50% cases, as against only 16% cases observed in our series. None of the other workers in this field have evaluated the incidence and percentage of signs and symptoms in their studies and hence a detailed comparison in symptomatology could not be done.

The range as well as mean haemoglobin values and erythrocyte sedimentation rates of our control and study group of cases have been depicted in table IX. The mean haemoglobin value in our control group of cases was 12 gm% (range 11-14 gm%) and mean erythrocyte sedimentation rate was 19 mm in Ist hour(range 12 to 25 mm in Ist hour). The mean haemoglobin value in cases of pharyngitis was 10.66 gm% with range of 9-13 gm% and mean erythrocyte sedimentation rate was 22.52 mm in Ist hour (range 15 to 35 mm in Ist hour).

The mean haemoglobin value in cases of acute rheumatic fever was 8.83 gm% (range 7.5 to 12 gm%) and mean erythrocyte sedimentation rate was 43.0 mm in Ist hour (range 30-56 mm in Ist hour). It is evident from the above observations that the mean haemoglobin values

were lower and mean erythrocyte sedimentation rates were higher in cases of pharyngitis and acute rheumatic fever in comparison to our control group of cases. None of the workers so far have attempted to study the mean haemoglobin values or erythrocyte sedimentation rate in their study hence our findings in these parameters could not be compared to that of others.

Main aim of our study was to assess the incidence of beta haemolytic streptococci by throat swab culture and to perform the ASO titre in both the study group of cases and compare the findings of these two groups of parameters with that observed in control group of children. It is evident from table X, that our of 10 control cases, throat swab culture of only one (10%) case showed the growth of beta haemolytic streptococci and 1(10%) case showed the growth of staphylococcus aureus, while the throat culture of the remaining 8(80%) cases had growth of non pathogenic bacteria. On the contrary, it is evident from table X that out of 50 cases of pharyngitis, 12(24%) cases showed the growth of beta haemolytic streptococci, 7(14%) cases showed the growth of staphylococcus aureus while 1(2%) case had the growth of micrococcus. Remaining 30(60%) cases showed growth of non pathogenic bacteria on the culture medium.

The throat swab culture was also performed in all the 12 cases of acute rheumatic fever. Our results

revealed, that out of 12 cases of acute rheumatic fever, throat swab culture of only 4(33.33%) cases showed the growth of beta haemolytic streptococci, while throat swab culture of remaining 8(66.67%) cases revealed the growth of non pathogenic bacteria on the culture medium.

The results of the throat swab culture in the various group of cases, amply demonstrate that acute rheumatic fever had the highest incidence of beta haemolytic streptococci (33.33%) as against 24% observed in cases of pharyngitis and only 10% in the control group of cases. Staphylococcus aureus was also found to be a cause of pharyngitis in 14% of cases, while none of the case of acute rheumatic fever demonstrated the presence of staphylococcus aureus, which again goes to prove that rheumatic fever is basically an aftermath of streptococcal infection. The growth of non pathogenic bacteria was found to be higher in the control group of cases (80%) as against cases of pharyngitis (60%) and cases of acute rheumatic fever (66.67%).

Koshi and Mammen (1969) unlike us, have reported a higher incidence (33.6%) of beta haemolytic streptococci in their control group of cases as against 10% cases reported by us. Gulati et al (1981) and Agrawal et al (1981) however reported the incidence of beta haemolytic streptococcal infection only in 6% and 7.9% control group of cases respectively. The presence of beta haemolytic streptococci in our 10% control group

of children, suggests a carrier state in these asymptomatic children.

Our findings of 24% positivity of beta haemolytic streptococci in cases of pharyngitis is slightly less than that reported by Koshi and Jadhav (1970), Agrawal et al (1981) and Gulati et al (1981) of 44%, 33.84% and 33.3% respectively. Paramesh (1984) and Bhave et al (1991) however reported a very high incidence of beta haemolytic streptococcal positivity (62% and 64% respectively) in cases of pharyngitis in their studies.

The difference in the incidence of beta haemolytic streptococcal positivity in various studies including us , can be easily explained to the antibiotic therapy which the children must have received prior to doing throat swab culture.

Only two of the workers in the past few decades did throat swab culture for beta haemolytic streptococci in cases of acute rheumatic fever. The results observed by Koshi and Mammen (1969) and Agrawal et al (1981) of 27.2% and 20% respectively are more or less similar (33.33%) to that observed in our series.

ASO titre was performed in all the group of cases and was categorised as significant ($\geq$200 IU/ml) or insignificant ($<$200 IU/ml). It is evident from table XI, that out of 10 control cases only 1(10%) case had significant ($\geq$200 IU/ml) ASO titre, while of the 50 cases of pharyngitis only 8(16%) cases had

significant ASO titre, while the remaining 42(86%) cases had insignificant ASO titre. It is also evident from table XI, that out of 12 cases acute rheumatic fever, 9(75%) cases had significant ASO titre, while the remaining 3(25%) cases had insignificant ASO titre. The results of ASO titre in different groups therefore highlight the fact, that highest incidence of significant ASO titre was observed in cases of acute rheumatic fever, followed by cases of pharyngitis, while obviously the least incidence was observed in control group of cases. A striking observation was that all the cases of acute rheumatic fever manifesting with carditis had significant ASO titre.

Our observations of significant ASO titre (200 IU/ml) in 10% control group of cases is more or less similar to results of significant ASO titre (10.7%) observed by Bhave et al (1991). Koshi and Mammen (1969) however, observed a higher incidence of significant ASO titre of 28.2% than that observed by us. Gulati et al (1981) on the other hand reported a lower incidence of significant ASO titre (3%) in their control group of cases.

Our findings of 16% significant ASO titre in cases of pharyngitis is much lower than that observed by Koshi and Jadhav (1970), Gulati et al (1981) and Bhave et al (1991) of 48.4%, 45.3% and 65% respectively. A much lower incidence of significant ASO titre observed by

us is easily explainable due to the fact that the incidence of beta haemolytic streptococci positively too, was also much lower in our study. Agarwal et al (1981) who showed more or less similar streptococcal profile as observed by us, have, however, not done the ASO titre in his study, hence comparison to their work could not be ascertained.

Our observations of significant ASO titre in 75% cases of acute rheumatic fever are similar to the results of significant ASO titre observed by Koshi and Mammen (1969) and Bhave et al (1991) of 75% and 76.6% respectively.

On further analysis we tried to observe a correlation between significant ASO titre to the throat swab culture profile in all the group of cases. A significant finding in this regard observed by us (Table XII), revealed that the single case in the control group, which had significant ASO titre, demonstrated the presence of beta haemolytic streptococci on throat swab culture.

In the pharyngitis group it was seen, that all the 8 cases demonstrating significant ASO titre had values between 200 to 400 IU/ml and none had values above 400 IU/ml. Further it was seen, that 4(50%) out of 8 cases of pharyngitis, demonstrated beta haemolytic streptococci, whereas the rest 4(50%) cases showed non pathogenic bacterial growth on throat swab culture

examination. A significant finding in the group comprising cases of acute rheumatic fever was that, of the 9(75%) cases showing significant ASO titre, 6(50%) cases had titre ⩽400 IU/ml, whereas 3(25%) cases had ASO titre ⩾400 IU/ml. It was seen that of the 9 cases showing significant ASO titre, 4(44.44%) cases demonstrated the presence of beta haemolytic streptococci, while 5 (55.56%) cases showed non pathogenic growth on throat swab culture.

In nut shell our study revealed that the highest incidence of beta haemolytic streptococci and significant ASO titre was found in cases of acute rheumatic fever viz. 33.33% and 75% respectively followed by pharyngitis, where beta haemolytic streptococcal positivity and significant ASO titre was found in 24% and 16% cases respectively. Normal healthy children which served as control however showed the growth of beta haemolytic streptococci and significant ASO titre only in 1 (10%) case.

Another significant inference that can be drawn from our study is that there seems to be a direct correlation between significant ASO titre and throat swab culture positivity of beta haemolytic streptococci. This is evident from our observations that in cases of pharyngitis having significant ASO titre (⩾200 IU/ml), demonstrated the presence of beta haemolytic streptococci in 50% cases. Further our view has been substantiated by the growth of beta haemolytic streptococci in the single control case manifesting with significant ASO titre. However, the

decreased incidence of streptococcal positivity (44.44%) in cases of acute rheumatic fever having significant ASO titre (Table XII) may be attributed to the fact, that in most of the cases throat swab culture was done 2 to 3 weeks after the onset of of symptoms by which time the child had received antibiotic prior to admission.

Our hypothesis of a direct correlation between the significant ASO titre and beta haemolytic streptococcal throat swab culture positivity has also been indirectly substantiated by the findings depicted in table XIII. It was seen that of all the 9 control cases showing insignificant ASO titre, none of the cases showed growth of beta haemolytic streptococci on throat swab culture. Similarly, in all the 3 cases of acute rheumatic fever, having insignificant ASO titre, none were positive for beta haemolytic streptococci on throat swab culture. This was further substantiated by our observations that of all the 42 cases of pharyngitis presenting with insignificant ASO titre, only 19.06% cases showed the growth of beta haemolytic streptococci, in contrast to 50% throat swab culture positivity of beta haemolytic streptococci in the cases of pharyngitis having significant ASO titre.

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SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSIONS

The present study was conducted in the department of Paediatrics in collaboration with departments of Microbiology and E.N.T., M.L.B. Medical College, Hospital, Jhansi over a period of one year from April, 1991 to March, 1992. The present work was carried out to study the throat swab culture and ASO titre in 50 cases of pharyngitis and 12 cases of acute rheumatic fever (1 to 15 years of age). Ten normal healthy children of the same age group served as control in the present study.

Primary aim of our study was to find out the incidence of streptococcal pharyngitis and to determine the ASO titre in cases of pharyngitis as well as in cases of acute rheumatic fever in children and to compare these values with those obtained in control cases.

Beside evaluating the throat swab culture and ASO titre various clinical features were also noted. Routine investigations, viz. TLC, DLC, Hb%, ESR were done in each case. It was our endeavour to ascertain inter-relationship if any, between a significant ASO titre and growth of the beta haemolytic streptococci on throat swab culture.

With these objectives in the view throat swab culture and ASO titre were done in all the cases of pharyngitis and acute rheumatic fever as well as all the ten control group of cases.

A total of 72 cases were examined in the present study, of which there were 50 cases of pharyngitis and 12 cases of acute rheumatic fever. Ten normal healthy children served as control in the present study.

AGE AND SEX DISTRIBUTION

The age and sex distribution of our cases of pharyngitis revealed that 76% cases were male and 24% cases were female. Majority of the cases (44%) were in the age group of 4-6 years. The age distribution of our cases of pharyngitis, demonstrate that upper respiratory tract infection predominates below the age of 6 years (76%) and the incidence gradually declines as the age advanced beyond 6 years. Similarly, a male preponderance was also observed in 12 cases of acute rheumatic fever in our study. In this group, there were 75% male and 25% female. The highest incidence of acute rheumatic fever (41.66%) was observed between 10 to 12 years of age. A significant finding was that there was no case of rheumatic fever below 3 years of age.

SOCIO-ECONOMIC STATUS

Maximum number of cases of pharyngitis (60%) as well as acute rheumatic fever (83.33%) belonged to low socio-economic status.

CLINICAL MANIFESTATION

Our observations showed that all 50 cases of pharyngitis had cough (100%) followed by fever (84%).

sore throat (70%) and glandular swelling over neck (16%). All the 50 cases of pharyngitis had inflammation and congestion of the pharynx. Twenty two (44%) cases revealed inflammation and congestion of the tonsils and 8(16%) cases had evidence of cervical adenitis.

The incidence of symptoms and signs in 12 cases of acute rheumatic fever revealed that all the 12 cases of acute rheumatic fever (100%) presented with fever, pain and swelling of the involved joints. Six (50%) cases had breathlessness while 3(25%) cases had cough, chest pain and sore throat. The complaint of palpitation was however, observed only in 1(8.33%) case. All the 12 cases of acute rheumatic fever had signs of joint swelling, tenderness, redness and restriction of movements of the involved joints. Fifty percent cases had evidence of carditis and congestive heart failure while none of our case had any evidence of erythema marginatum, subcutaneous nodules or evidence of rheumatic chorea. The associated evidence of pharyngitis and tonsillitis was observed in 3(25%) cases, while cervical adenitis was seen only in 2(16.67%) cases.

HAEMATOLOGICAL INVESTIGATIONS

The mean haemoglobin values in cases of pharyngitis and acute rheumatic fever were 10.66 and 8.83 gm% respectively and these values were found to be lower to the values observed in the control group of cases (12 gm%). The mean ESR was found to be highest in cases of acute

rheumatic fever (43.0 mm in 1 hour) as compared to the values observed in cases of pharyngitis (22.52 mm in 1 hour) and control group of cases (19 mm in 1 hour).

THROAT SWAB CULTURE AND ASO TITRE

The main aim of our study was to assess the incidence of beta haemolytic streptococci by throat swab culture and to perform the ASO titre in both the study group of cases and compare the findings of these two group of parameters with that observed in control group of children. The throat swab culture reports of various study group of cases showed that out of 10 control cases, throat swab culture of only 1 (10%) case showed the growth of beta haemolytic streptococci and 1(10%) case showed the growth of staphylococcus aureus, while the throat culture of the remaining 8(80%) cases had the growth of non pathogenic bacteria (commensals of the throat). On the contrary it is evident that out of 50 cases of pharyngitis,12(24%) cases showed the growth of beta haemolytic streptococci, 7(14%) cases revealed the growth of staphylococcus aureus, while 1 (2%) case had growth of micrococcus. Remaining 30(60%) cases showed growth of non pathogenic bacteria on the culture medium.

Throat swab culture was also performed in all the 12 cases of acute rheumatic fever. Our results revealed that out of 12 cases of acute rheumatic fever, throat swab culture of 4(33.33%) cases showed the growth of beta

haemolytic streptococci, while throat swab culture of remaining 8(66.67%) cases revealed the growth of non pathogenic bacteria on the culture medium.

The results of throat swab culture in the various study group of cases amply demonstrate that acute rheumatic fever had the highest incidence of beta haemolytic streptococci i.e. 33.33% as against 24% observed in cases of pharyngitis and only 10% in the control group of cases. Staphylococcus aureus was also found to be a cause of pharyngitis in 14% of cases, while none of the case of acute rheumatic fever, demonstrated the presence of staphylococcus aureus which again goes to prove that rheumatic fever is basically an aftermath of streptococcal infection. The growth of non pathogenic bacteria was found to be higher in the control group of cases (80%) as against cases of pharyngitis (60%) and cases of acute rheumatic fever (66.67%).

The results of ASO titre in different study group of cases highlight the fact that highest incidence (75%) of significant ASO titre (7200 IU/ml) was observed in cases of acute rheumatic fever, followed by cases of pharyngitis (16%), while obviously the least incidence(10%) was observed in control group of cases. A striking observation was that all the cases of acute rheumatic fever manifesting with carditis had significant ASO titre.

Our study reveals that the highest incidence of beta haemolytic streptococcal positivity and significant

ASO titre viz. 33.33% and 75% respectively, was found in cases of acute rheumatic fever, followed by pharyngitis in which beta haemolytic streptococcal positivity and significant ASO titre was found in 24% and 16% cases respectively. Normal healthy children which served as control had showed the growth of beta haemolytic streptococci/and significant ASO titre only in 10% cases.

In nut shell, a significant inference that can be drawn from our study is that there seems to be a direct correlation between the significant ASO titre (7200 IU/ml) and throat swab culture positivity of beta haemolytic streptococci. This is evident from our observations that in cases of pharyngitis having significant ASO titre, 50% of cases demonstrated the presence of beta haemolytic streptococci as well as by the growth of beta haemolytic streptococci in the single control case manifesting with significant ASO titre. However, the decreased incidence of streptococcal positivity (44.44%). in cases of acute rheumatic fever having significant ASO titre, may be attributed to the fact that in most of the cases throat swab culture was done 2 to 3 weeks after the onset of symptoms by which time the child had received antibiotics prior to admission.

Our hypothesis of a direct correlation between the significant ASO titre and beta haemolytic streptococcal throat swab culture positivity Has also been indirectly substantiated by the findings, that of all the 9 control

cases showing insignificant ASO titre (⟨200 IU/ml), none of the case showed growth of beta haemolytic streptococci on throat swab culture. Similarly, in all the 3 cases of acute rheumatic fever having insignificant ASO titre, none were positive for beta haemolytic streptococci on throat swab culture.

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A P P E N D I X

WORKING PROFORMA

DEPARTMENT OF PEDIATRICS, M.L.B. MEDICAL COLLEGE, JHANSI

"STUDY OF BETA HAEMOLYTIC STREPTOCOCCI AND ASO TITRE IN PHARYNGITIS AND ACUTE RHEUMATIC FEVER IN CHILDREN

GUIDE : Dr. R.S. Sethi, MD, DCH,
Assistant Professor,
Department of Paediatrics,
M.L.B. Medical College, Jhansi.

Investigator : Dr. B.S. Yadav.

Case No.

MRD|OPD No. _____ Date:

Patient's name Ward/Bed

Age/Sex DOA

Address DOD

CHIEF COMPLAINTS

A. Fever :
   a. Onset : Acute/Chronic
   b. Duration :
   c. Severity : Mild/Moderate/High
   d. Type : Continuous/Intermittent/Remittent
   e. Association : Headache/Vomiting/Rashes

B. Cough
   a. Onset
   b. Duration
   c. With or without expectoration
   d. Sputum - Mucoid/Mucopurulent/Purulent/Blood stained.

C. Sore throat(Pain on shwallowing) : Present/absent
   Duration

D. Mouth breathing/Difficulty in respiration: Present/absent
   Duration

E. Loss of weight/Appetite : Present / Absent
   a. Duration: b. Amount :

F. Swelling over neck : Present / absent

a. Onset b. duration

c. Painful/Painless d. Progressive

G. Joint pain/swelling : Present/absent

a Onset b. Duration

c. Joint involved d. Association :
Fever/Pain/Rashes/
Subcutaneous nodules

H. Breathlessness : Present/absent

a. Onset b. Duration

c. Severity

I. Chest pain : Present/absent

a. Onset e. Duration
b. Site f. Severity
c. Radiation g. Aggrevating factors
d. Relieving factors

J. Any other complaints :

HISTORY OF PAST ILLNESS

a. H/o sore throat
b. H/o Joint pain/swelling
c. H/o Measles/mumps/whooping cough/chicken pox/T.B.
d. Any other

FAMILY HISTORY

a. H/o T.B. or any other infectious disease

b. H/o rheumatic fever.

GENIOLOGICAL HISTORY

DIETARY HISTORY

a. Calories : b. Proteins :

DEVELOPMENTAL HISTORY

IMMUNIZATION HISTORY

SOCIOECONOMIC HISTORY

GENERAL EXAMINATION

G.C.	Hydration
Pulse	Oedema
B.P.	Clubbing
Temperature	Lymphadenopathy
Icterus	Adenoidal facies
Cyanosis	J.V.P.
Pallor	Any other

ANTHROPOMETRIC EXAMINATION

Height — Weight

Head circumference : Mid arm circumference

LOCAL EXAMINATION

A. Tonsil
   a Normal/inflammed
   b. Size : Normal/enlarged - acute hypertrophy
   - chronic
   c. Surface : exudate/follicle/PNS/membrane

B. Pillars : Anteriors
   Posterior

C. Pharynx : Normal/inflammed - acute
   chronic
   Exudate - Present/Absent

D. Cervical Lymph node
   a. Size
   b. Shape
   c. Tender/Nontender
   d. Surface
   e. Consistency
   f. Discrete/matted
   g. Mobile/fixed

SYSTEMIC EXAMINATION

A. Respiratory system

a. Inspection b. Palpation
c. Percussion d. Auscultation

B. Cardiovascular system

a. Inspection b. Palpation
c. Percussion d. Auscultation

C. Abdomen

a. Inspection b. Palpation
c. Percussion d. Auscultation

D. C.N.S.

a. Examination of higher function :
b. Examination of cranial nerves :
c. Examination of motor system :
i) Bulk iii) Power
ii) Tone iv) Co-ordination
d. Sensory system
e. Reflexes : Superficial/deep
f. Gait
g. Cerebellar signs
h. Signs of meningeal irritation.

INVESTIGATIONS

a. Blood : TLC, DLC, Hb gm%, E.S.R.
b. Urine : Albumin, Sugar :
M/E :
c. X-racy chest
d. Throat swab culture
e. ASO Titre

SUMMARY OF THE CASE

PROVISIONAL DIAGNOSIS

COMMENTS